

CLAIMS

WHAT IS CLAIMED IS:

1. A method of making an erbium-doped optical fiber for use in optical
5 amplifiers, comprising the steps of:
 - a) providing a substrate tube;
 - b) depositing high purity silica-based cladding layers on the inside of the tube;
 - c) depositing a core glass that comprises silica, Al, a non-fluorescent rare-
10 earth ion, Ge, Er, and Tm;
 - d) collapsing the tube to form a preform
 - e) drawing the preform to yield optical fiber.
2. The method of claim 1, wherein the non-fluorescent rare-earth ion is La.
3. The method of claim 2, wherein
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 - a) the concentration of Er is from 15 ppm to 3000 ppm;
 - b) the concentration of Al is from 0.5 mol% to 12 mol%;
 - c) the concentration of La is less than or equal to 2 mol%;
 - d) the concentration of Tm is from 15 ppm to 10,000 ppm; and
 - e) the concentration of Ge is less than or equal to 15 mol%.
- 20 4. The method of claim 1, the core further comprising F.
5. The method of claim 3 wherein the concentration of F is less than or equal to 6 anion mol%.
6. The method of claim 1, wherein the concentration of Er is from 150 ppm to 1500 ppm.
- 25 7. The method of claim 1, wherein the concentration of Al is from 4 mol% to 10 mol%.
8. The method of claim 1, wherein the concentration of Tm is from 150 ppm to 3000 ppm.
9. The method of claim 1, wherein the concentration of Ge is from 1 mol% to 15 mol%.
- 30 10. The method claim 1, where the concentration of Al is greater than 1 mol%.

11. The method of claim 2, where the concentration of Al plus Ge plus La is greater than 5 mol%.
12. The method of claim 2, where the concentration of Al plus Ge plus La is greater than 10 mol%.
- 5 13. The method of claim 1, where the concentration of Tm is greater than 150 ppm.
14. The method of claim 1, where the concentration of Tm is greater than 1000 ppm
15. The method of claim 1, where the concentration ratio of Tm/Er is at least 1.
- 10 16. The method of claim 1, wherein the cladding layers are free of boron.
17. The method of claim 1, wherein the cladding layers contain Si, F, P, and O.
18. The method of claim 1, wherein the step of depositing the core glass includes making multiple MCVD passes.
19. The method of claim 1, wherein the step of depositing the core glass includes making multiple sol-gel passes.
- 15 20. The method of claim 1, wherein the step of depositing the core glass includes making multiple soot deposition, solution doping, and consolidation passes.
21. The method of claim 1, wherein the non-fluorescent rare-earth ion is Y.
22. The method of claim 1, wherein the non-fluorescent rare-earth ion is Sc.
- 20 23. The method of claim 1, wherein the non-fluorescent rare-earth ion is Lu.
24. A method for manufacturing an extended L-band amplifier comprising the steps of:

- a) providing an optical fiber having a core that comprises silica, Al, a non-fluorescent rare-earth ion, Ge, Er, and Tm; and
- 25 b) coupling the optical fiber to a pump laser.